XIV. *On the Meteorological Observations made at the Apartments of the Royal Society during the Years* 1827, 1828, *and* 1829. *By* J. W. Lubbock, *Esq. V.P. & Treas. R.S.*

Read April 14, 1831.

THE phenomena which principally deserve attention connected with the science of meteorology, are:

1. The annual and diurnal variations of the barometer and thermometer, due to the action of the sun.

2. The variations of the barometer due to the moon, and dependent on her age.

3. The comparative temperature and barometrical pressure at different points of the earth's surface, the isothermal lines, and lines of equal barometrical pressure.

4. The influence of the direction of the wind on the temperature and barometrical pressure.

5. Phenomena connected with the electrical state of the air, the aurora borealis, &c.

In order to determine the annual variations of the barometer, I have taken the mean of the observations in each month, made at the apartments of the Royal Society, during the years 1827, 1828, 1829, and 1830. The results are given in the following Table, which shows the differences from the mean*.

The two first columns result from these observations, reduced to 32° Fahr., and corrected for capillarity.

The four other columns are deduced from Table 3 in the valuable work of M. Bouvard "Sur les Observations Météorologiques." (Mémoires de l'Academie des Sciences. Vol. vii. p. 312.)

* The mean result being given for each year separately in the Philosophical Transactions, of course it was only necessary for me to add these together, and take the fourth. Since the reading of the paper, the observations of 1830 have been added and taken into account.

	Obsns at Somerset House.		Obsns at the Paris Observatory.			
	9 A.M.	3 P.M.	9 A.M.	12.	3 P.M.	9 P.M.
January	+.006	+.005	+.085	+.067	+.072	+.069
February ..	+.064	+.070	+.071	+.070	+.065	+.063
March	−.004	−.009	−.006	−.004	−.007	−.005
April	−.044	−.143	−.044	−.047	−.053	−.042
May	+.002	−.025	−.044	−.043	−.047	−.046
June	+.006	−.031	+.037	+.040	+.040	+.064
July	−.017	−.022	+.008	+.004	+.009	+.008
August	−.005	−.001	+.018	+.016	+.014	+.013
September ..	−.039	−.048	+.016	+.014	+.015	+.019
October	+.117	+.116	−.063	−.060	−.062	−.056
November ..	+.036	+.025	−.021	−.015	−.012	−.011
December ..	−.006	+.005	−.047	−.042	−.035	−.039
Mean	29.861	29.840	29.778	29.767	29.748	29.762

Thus the mean height of the barometer at 9 A.M. for January is 29.861 + .006 = 29.867.

It may be remarked, that according to this Table, the annual variations appear to be independent of the diurnal variations. The Paris observations present much greater regularity than those made here, which results perhaps from their greater number. In order to determine the diurnal variations of the barometer, it is necessary that the observations should be repeated much more frequently in the course of the day than is done here at present. The mean height of the barometer here at 9 in the morning is greater by .021 inch (or about $\frac{1}{50}$th of an inch), than at 3 in the afternoon; and so regular is this diurnal variation, that considering the mean of each month separately for the years 1827, 1828, 1829, and 1830, there are only two cases in which the mean height is greater at 3 in the afternoon than at 9 in the morning. The corresponding difference at Paris is .030 inch *.

In order to determine the fluctuations of the barometer due to the moon, it would have been desirable to possess many more observations; but, unfortunately, previous to 1827, the observations of the barometer at Somerset House seem not to have been made at stated times of the day, a condition which appears to me absolutely necessary, in order that meteorological observations

* There is a very interesting paper on the annual and diurnal variations of the barometer, by M. Carlini, in the 20th volume of the Memorie della Società Italiana. Fasc. 1mo. (Memorie di Matematica.)

may be applied to this or any other useful purpose, except that of serving at the time to prognosticate the weather, or but imperfectly to determine the correction due to the direction of the wind.

I was therefore obliged to confine myself to the years 1827, 1828, and 1829. The method which I have adopted with respect to these aerial tides is similar to that which I have used in order to determine the phenomena of the tides in the river Thames, and consists in classifying all the heights of the barometer, and taking their mean, which correspond to a particular age of the moon, defined by the circumstance of her transit taking place in a given half-hour of the day. Thus all the days in the years 1827, 1828, and 1829, were found when the moon passed the meridian between 12 and half past 12, and the mean of the transits taken, which of course is nearly a quarter past 12; the heights of the barometer were then taken on the same days, and the mean taken; and thus all the transits of the moon which occurred during the years 1827, 1828, and 1829, were taken, and the corresponding observed heights of the barometer selected and compared with them. The height of the attached thermometer was also taken, and the mean height of the barometer corrected afterwards by the mean height of the attached thermometer, so as to reduce it to 32° Fahr.

Although the transits of the moon were at first classed for every half-hour, I afterwards combined them for every hour, in order to make use of a greater number of observations in obtaining results. The mean transit thus found, scarcely differed from the half-hour, which is therefore taken as the time of the moon's transit in the following Table, in which the results are exhibited.

Table.

No. of Obs.	Time of Moon's transit.	Moon's age.	9 o'clock A.M.				3 o'clock P.M.			
			Barom.	Attach. Therm.	Barom. red. to 32° Fahr.	Diff. of Barom. from mean.	Barom.	Attach. Therm.	Barom. red. to 32° Fahr.	Diff. of Barom. from mean.
	h. m.	days.	inches.		inches.	inch.	inches.		inches.	inch.
85	0 30 or 12 30	.6 or 15.3	29.983	54.3	29.926	+.063	29.956	55.9	29.894	+.055
87	1 30 or 13 30	1.8 or 16.6	29.951	55.5	29.891	+.028	29.913	57.4	29.859	+.010
90	2 30 or 14 30	3.0 or 17.8	29.916	54.0	29.860	−.003	29.898	56.0	29.836	−.003
89	3 30 or 15 30	4.3 or 19.1	29.892	53.8	29.836	−.027	29.883	55.5	29.823	−.016
88	4 30 or 16 30	5.5 or 20.3	29.904	53.3	29.849	−.014	29.891	54.8	29.832	−.007
92	5 30 or 17 30	6.8 or 21.5	9.896	53.8	29.840	−.023	29.892	56.1	29.830	−.009
86	6 30 or 18 30	7.9 or 22.7	29.924	54.0	29.868	+.005	29.897	56.1	29.835	−.004
93	7 30 or 19 30	10.4 or 25.2	29.899	53.9	29.843	−.020	29.884	55.7	29.823	−.016
87	8 30 or 20 30	10.4 or 25.2	29.890	53.9	29.834	−.029	29.870	55.6	29.809	−.030
86	9 30 or 21 30	11.7 or 26.4	29.910	53.6	29.855	−.008	29.901	55.8	29.839	.000
88	10 30 or 22 30	12.9 or 27.7	29.911	52.9	29.857	−.006	29.913	55.2	29.854	+.015
88	11 30 or 23 30	14.2 or 28.9	29.938	53.1	29.874	+.011	29.919	55.2	29.860	+.021
	Mean		29.919	53.9	29.863		29.901	55.8	29.839	

The following Table results from Table VI. of M. BOUVARD, (p. 316,) reduced to English feet.

	Variation of Barometer from mean.	
	9 A.M. inch.	3 P.M. inch.
Day of the Syzygy.....	—.004	—.008
First day after the Syzygy.....	—.010	—.006
Second day after the Syzygy.....	—.013	—.009
Second day before Quadrature....	+.008	+.005
First day before Quadrature.....	+.024	+.032
Day of the Quadrature.....	+.025	+.017
First day after the Quadrature....	—.002	—.001
Second day after the Quadrature ..	—.000	+.012
Second day before the Syzygy	—.019	—.018
First day before the Syzygy.....	—.009	—.019
Mean height	29.781	29.748

The results afforded by the observations at Somerset House differ widely from those above obtained by M. BOUVARD from the observations at the Paris Observatory; according to the former, the barometer is highest at new and full moon and lowest at quadrature; according to the latter, the contrary is the case.

The extent of the fluctuations of the barometer due to the moon according to the former is about .08 or nearly $\frac{1}{10}$th of an inch, according to the latter only ·05 or $\frac{1}{20}$th of an inch.

They agree in this, that the fluctuations take place nearly in the same manner in the morning and in the afternoon; whence it follows, that the period of the principal inequality of the height of the barometer due to the action of the moon is not the same as that of the ocean; for if it were so, as the observations are made at a distance of six hours, the maximum in the morning would correspond to the minimum in the afternoon.

LAPLACE enumerates among the most important causes of the fluctuation of the pressure of the atmosphere, the rising and falling of the ocean due to the action of the sun and moon, the ocean serving as the basis or support of the atmosphere. But with that deference which is due to the authority of so great

a mathematician, I must confess that this cause does not appear to me adequate to produce any sensible effect; for in the open sea the variations of the height of the water due to the tides, where this cause would be most felt, do not exceed three or four feet, and any considerable rise of the tide is in general confined within very narrow limits, as in channels and between the banks of rivers. Lastly, I have endeavoured to ascertain how far the barometer is affected by the direction of the wind; and the following Table gives the results which I have obtained with this view. The fluctuation due to this is much greater than that due to any other cause; and it is therefore very important that this correction should be carefully ascertained, in order that it may be applied when observations of the barometer are classed, in order to determine any other inequality. The barometer is lowest, as might be expected, in the rainy quarters, as S.W. and W.S.W.

TABLE showing results deduced from the Meteorological Observations made at Somerset House during the years 1827, 1828, and 1829, classed according to the direction of the Wind.

Direction of the Wind at 9 A.M.	No. of Observations.	9 o'clock A.M.		3 o'clock P.M.		Dew point at 9 A.M. in degrees of FAHR.	Rain in inches, read off at 9 A.M.
		Barometer.	Attach. Therm.	Barometer.	Attach. Therm.		
N	117	30.009	47.4	30.014	49.3	41	.019
NNE	88	30.068	52.2	30.043	54.0	45	.032
NE	35	29.923	49.3	29.912	51.1	42	
ENE	16	30.005	49.4	29.941	52.8	45	.100
E	74	29.915	53.2	29.889	55.8	47	.021
ESE	68	29.951	52.5	29.916	54.2	45	.022
SE	30	29.793	57.8	29.772	59.2	52	.053
SSE	39	29.742	55.8	29.680	57.9	51	.052
S	73	29.808	54.4	29.795	56.4	49	.033
SSW	88	29.815	56.7	29.782	58.5	51	.038
SW	103	29.884	54.8	29.835	56.6	48	.069
WSW	143	29.900	54.5	29.898	56.7	48	.059
W	83	29.944	57.0	29.936	59.1	49	.059
WNW	18	29.889	57.2	29.887	60.0	50	.053
NW	65	29.936	55.6	29.802	57.4	46	.054
NNW	56	29.978	54.8	30.014	56.8	46	.080
Mean of Total		29.918	54.7	29.893	55.7	47	.044

TABLE deduced from the preceding, showing the variations of the Barometer reduced to 32° FAHR.

Direction of the Wind.	No. of Observations.	9 A.M.	3 P.M.
N	117	+.114	+.140
NNE	88	+.158	+.155
NE	35	+.021	+.032
ENE	16	+.100	+.056
E	74	−.002	−.005
ESE	68	+.038	+.029
SE	30	−.128	−.128
SSE	39	−.178	−.218
S	73	−.107	−.098
SSW	88	−.106	−.113
SW	103	−.034	−.056
WSW	143	−.015	+.003
W	83	+.023	+.036
WNW	18	−.032	+.013
NW	65	+.013	−.093
NNW	56	+.018	+.118
Mean		29.863	29.835

I shall not attempt to enter into any discussion of the influence of electrical phenomena upon the weather; no observations with reference to this part of the subject have yet been made here.

I have to acknowledge the very kind assistance of Mr. DEACON, (to whom I have been indebted before,) in forming the Tables which accompany this paper. I have not discussed the circumstances under which the observations have been made which serve for the foundation of the results which are here presented, although I fear that the instruments employed are unworthy of the Society and of the care bestowed upon the observations by Mr. HUDSON. This discussion would have been necessary if my object had been to determine the mean temperature or the mean barometrical pressure at London; but as I have only endeavoured to ascertain the fluctuations of the barometer due to certain causes, whose periods are independent of any errors that may arise from the construction and condition of the instruments, those errors are of little importance in the preceding investigation.

Since this paper was read, Mr. HUDSON has made some observations with a view to determine the diurnal variation of the barometer; they were begun on the 26th of April, and have been continued to the present time, June 13th. The results are exhibited in the following Table, which seem to indicate a minimum about 6 o'clock P.M.

Mean Times of Observation.	Number of Observations.	Barometer.	Attached Thermometer.	Barometer corrected, and reduced to 32°.	Difference of Barometer from Mean.
A.M. h. m.					
9 0	49	29.900	61.4	29.821	+.025
10 4	43	29.885	62.8	29.803	+.008
11 2	47	29.895	62.4	29.814	+.019
12 3	38	29.902	63.3	29.819	+.024
P.M.					
1 4	43	29.866	63.5	29.783	—.012
2 3	44	29.887	63.8	29.803	+.008
3 1	49	29.880	63.4	29.797	+.002
4 3	40	29.868	64.1	29.783	—.012
5 2	44	29.856	63.5	29.773	—.022
6 4	39	29.837	63.6	29.753	—.042
7 3	37	29.877	63.2	29.794	—.001
8 4	36	29.858	61.5	29.779	—.016
9 3	38	29.863	61.0	29.785	—.010
10 2	33	29.896	60.8	29.819	+.024
11 2	34	29.884	60.9	29.806	+.010
11 57	34	29.874	60.4	29.790	—.005
Mean		29.877	62.6	29.795	